branches, which themselves repeatedly branch, and are closely covered with scales. A further examination shows that this is the universal rule with the species, no normal inflorescence developing. The adventitious inflorescence always bears a definite relation to the position of the parasitic roots: that portion of the stem which produces roots, always produces flowers; and the greater the number of the former, the larger is the number of the latter. The stem proper dies away soon, not only between the inflorescence, but also in the flower-clusters themselves. The flowering branches establish direct structural connection with the host plant. When this is accomplished, the scales upon the branches often contain considerable quantities of chlorophyl.

A short paper by Prof. B. G. Wilder was read on the subject of the serrated appendages of Amia. The view held by Sagemehl and Ramsey Wright, that these organs are accessory respiratory organs, is found to be sustained by the experiment which Professor Wilder performed on the living animal; and his conclusions are, that, while the appendages have no function at the present day, it is quite probable that their development and paleontological history are well worth careful study.

Dr. C. S. Minot discussed the subject of the relation between histological differentiation and death, and arrived at the conclusion, that the only rational explanation of the fact that animals and plants undergo progressive decay, as well as a progressive development, is to be found in the fact that highly differentiated structures, or organs, have lost the plasticity of embryonic tissues, and are incapable of renewing themselves when once worn out: in consequence of this, death is the price paid by the higher organisms for their advanced organization.

In another paper, on the morphology of the supra renal capsules, Dr. Minot made an important addition to our knowledge of the structure of these still problematical organs. The structure of the capsule is similar throughout. There are masses and cords of cells which are in radial lines externally, but which are irregularly arranged internally. The cells of the medulla and cortex are almost identical in appearance in a six months' human foetus, on which account it is difficult to admit a double origin for the capsules. The same speaker presented a paper on a new membrane of the human skin, which he homologizes with the epitrichium of the lauropsida. It is situated outside the horny layer, and is entirely distinct from it: an extension covers both hairs and glands. It probably causes the vernix caseosa by retaining the sebaceous secretion.

An interesting and important paper on the embryology of Onoclea and other ferns was contributed by Mr. D. H. Campbell of Detroit, the details of which cannot be given here. Drs. D. E. Salmon and T. Smith of Washington, D.C., read a paper on a new chromogenous bacillus (Bacillus luteus suis). This form is non-pathogenic, and was found in the pericardial and peritoneal fluids in swine killed for the purpose of studying the swine fever. When grown in a meat infusion, the liquid becomes pale straw color, then orange with a greenish tint, soon changing to a wine red. The pigment when obtained pure is insoluble in alcohol or ether. An aqueous solution is decolorized by adding an excess of strong HNO_3, or HCl, but reappears on neutralizing with potassium hydrate, or ammonia.

The relation of ovary and perianth in the development of dicotyledons was discussed by Prof. J. M. Coulter. A most simple and important character of systematic value was discovered in the study of the embryology of the dandelion; and, on comparing with the same embryonic stages of a large number of families, it was found that the character of superior or inferior ovary was the first recognized. In the case of an inferior ovary, the protuberance, which is to develop into the flower, is arrested in its axial development, grows perpendicularly into a collar (the nascent floral envelopes), and soon there appears an external constriction distinguishing the floral envelopes above from the ovary below. In the case of a superior ovary, the axial development is continued, and there is no external constriction. On such a basis the Compositae stand at the head of the list, then Umbelliferae, Rubiaceae, etc. The second group, that of a superior ovary, includes Leguminosae, Scrophulariaceae, Labiatae, etc. A paper on the structure and functions of the sphaeridia of the Echinoidea was read by Dr. Howard Ayers. The observations of Lovén were supplemented by a large number of structural facts, which, besides allowing of greater accuracy in determining the function of these peculiar organs, furnish an example of a highly specialized organ in this group that is comparable to the otolith sacs of Synapta. The following papers were read, of which extracts cannot be given here: 'The importance of individual facts of environment in the formation of groups of animals,' by Prof. J. B. Steere; 'On the morphology of the carapax and sternum of the decapod Crustacea,' by Dr. H. Ayers; 'Notes on some injurious fungi of California,' by Prof. W. G. Farlow; 'On the evolution of the lungs,' by Dr. C. S. Minot.

THE LIMITATIONS AND VALUE OF HISTOLOGICAL INVESTIGATION.[1]

WHILE choosing a subject relating chiefly to microscopic structure for the address before the section of histology and microscopy, I wish first to discuss briefly what constitutes a complete knowledge of structure, and what are the limitations and value of this knowledge. The knowledge of structure depends greatly upon the coarser, i.e., the macroscopic relations. There is no magic in the microscope; it is simply a tool, nothing more. It is as illogical and hopeless to expect to understand the structure of an organ from what can be learned of it under the microscope alone, as for a geologist to expect to understand the topography of a continent by studying the sand of its sea-shore.

[1] Abstract of an address delivered before the section of microscopy and histology of the American association for the advancement of science, at Ann Arbor, Aug. 26, by Prof. S. H. GAGE of Cornell University, vice-president of the section.

Microscopic anatomy should show: 1°. The nature and relations of the structural elements which combine to form any organ or tissue. 2°. The blood-supply. 3°. The lymph-supply. 4°. The nerve-supply, and relation of the nerves to the structural elements. 5°. The development of the structural elements, and their combination to form the various tissues. The structure of no tissue or part is known in all this detail. This is both encouraging and discouraging; for, while we see many problems unsolved, we know that they are problems which have eluded the grasp of the greatest anatomists of the world.

It is often said that a certain tissue must perform a given function on account of its structure; but we know that a moner or an amoeba performs all the life functions observed in the higher animals, and hence it seems hopeless to tell by structure alone what the function of individual cells composing one of the higher animals must be. Claude Bernard has said that structure is the key to the grosser and merely mechanical functions alone; and this is fully justified by the facts, that, before his work, the liver was thought to simply produce bile, and the pancreas to secrete saliva; yet the physiologist Bernard found the liver a manufactory of sugar, and the pancreas producing a juice with the powers of all the digestive ferments combined with the power of emulsifying fat. While, therefore, the most intimate structural knowledge gives no hint of the function of a tissue, it is of great value when the function is known in determining the significance of the structural relations.

Knowing the special differentiations accompanying a function, it is usually safe to assume that a similar structure will possess similar properties, and perform nearly the same function, no matter where found. Structural knowledge is also of great value to the morphologist, helping him to recognize and homologize the organs of different animals. Finally, without the knowledge of structure added to the knowledge of physiology, the splendid achievements of modern surgery would be impossible. While our structural knowledge is already great and valuable, our insight into the relations of structure to function is still very slight.

While specialization of function and differentiation of structure are concomitant, no one as yet can state the finer structural relations which accompany extreme specialization of function. It is not difficult to detect a nerve-fibre; but, from appearance, no one can yet say whether its function is associated with motion, sensation, or secretion: between these functions the gulf remains impassable.

Let me now call attention to the structure of an organ in the pharynx of the soft-shelled turtles, and briefly state my reasons for claiming that the mucous membrane of the pharynx is a *respiratory* organ. These turtles remain voluntarily from two to ten hours under water; and, while under, fill the pharynx with water, and expel it about sixteen times per minute: water so used has lost part of its free oxygen, and gained much carbon dioxide.

The pharyngeal mucosa is densely covered with minute cylindrical compound, or filamentous papillae, having the appearance of the villous coat of the intestinal mucosa. This membrane begins opposite the tongue's base, and extends to about opposite the third cervical vertebra, where it passes into the oesophageal mucosa, the beginning of which is surrounded by a sphincter, thus marking off the respiratory chamber. The epithelium of the mouth, pharynx and oesophagus consists of nonciliated nucleated cells, is many layered and stratified in the mouth, but gradually becomes columnar in the pharynx. The columnar cells are interspersed with small cells wedged into the spaces between their inner ends. Both kinds of cells send processes from their inner ends to help form the strong basement membrane. Sometimes the small cells are connected with the stellate cells of the deeper tissue by long processes. Beaker cells are found in the pharynx and oesophagus, but not in the strictly respiratory part. The blood-supply is copious, consisting of a capillary net work. A plexus of non-nucleated nerves gives off branches to the papillae, and probably terminate in the taste-buds (neuro-epithelia) found there.

Such is in brief the structure of this membrane. What is the special significance of this structure? Does it agree with other respiratory membranes? In the gill of a fish the blood-supply is abundant, as here; but the epithelium is tessellated, not columnar. In the external gills of the tadpole and newt, the structure is much the same, except that a columnar ciliated epithelium intervenes between blood-supply and the water. In the inner gill of the tadpole and external of Necturus a pavement epithelium is present. If compared with the lung membranes of air-breathers, there is a general agreement of structural facts; but the structure of each of these membranes stands out clearly from all the rest, that of the turtle resembling none so much as it does the villous membrane of the small intestine of a mammal. Yet the principal function of each of these membranes is the passing into the blood of oxygen, and the passing out from the blood of carbon dioxide. That these membranes vary widely as regards structure, while possessing identical functions, is but one more demonstration of the fact that, if we would have the whole truth, the study of structure and function must go hand in hand.

PROCEEDINGS OF THE SECTION OF HISTOLOGY AND MICROSCOPY.

WE have to record the cessation of section G, histology and microscopy, of the American association. This anomalous section, finding its end near, proceeded with dignity to request the association to kill it: the request has been granted, and we are consequently forced to write an obituary of an existence which we have long disapproved. Not that we are in any way opposed to microscopy, the most delightful of what-not sciences, but because microscopy had to be dignified by rob-